

## WHAT IS CLAIMED IS:

- 1     1.     A gas concentration detecting apparatus comprising a gas concentration  
2     sensor including a first cell having a solid electrolyte element and a pair of  
3     electrodes disposed on said solid electrolyte element for pumping out and in  
4     oxygen of a gas to be detected introduced into a chamber and a second cell having  
5     a solid electrolyte element and a pair of electrodes disposed on said solid  
6     electrolyte element for detecting a concentration of a specific gas component of  
7     said gas after passing through said first cell, with an oxygen concentration signal  
8     being outputted on the basis of a current flowing when a voltage is applied to said  
9     first cell and a specific gas concentration signal being outputted on the basis of a  
10    current flowing when a voltage is applied to said second cell,  
11        wherein a decision on activation of said first cell and a decision on  
12    activation of said second cell are separately made in the middle of activation of  
13    said gas concentration sensor, and a decision indicative of the activation of said  
14    second cell is made after a decision is made that the activation of said first cell  
15    reaches completion.
- 1     2.     The apparatus according to claim 1, wherein said first cell electrode  
2     provided in said chamber is a specific-gas inactive electrode inactive in said  
3     specific gas component, while said second cell electrode provided in the same  
4     chamber is a specific-gas active electrode active in said specific gas component.
- 1     3.     The apparatus according to claim 1, wherein said gas concentration sensor  
2     further includes a third cell for detecting a residual oxygen concentration of said  
3     gas after passing through said first cell so that said voltage to be applied to said  
4     first cell is variably controlled on the basis of a detection result in said third cell.
- 1     4.     The apparatus according to claim 1, further comprising an element  
2     resistance detecting means for detecting a resistance value of said solid electrolyte

3 element of any one of said cells to implement control on element activation so that  
4 the detected element resistance value is kept at a predetermined target value, and  
5 the transition of said element resistance value detected by said element resistance  
6 detecting means is monitored in the middle of the activation of said gas  
7 concentration sensor, and when said element resistance value reaches an  
8 activation decision value based upon said target value, a decision is made that said  
9 first cell reaches its activation.

1 5. The apparatus according to claim 4, wherein, when said element resistance  
2 value detected by said element resistance detecting means in the middle of the  
3 activation of said gas concentration sensor reaches said activation decision value  
4 and a predetermined period of time elapses after the detected element resistance  
5 value reaches said activation decision value, a decision is made that said first cell  
6 reaches the activation.

1 6. The apparatus according to claim 4, wherein, when said element resistance  
2 value detected by said element resistance detecting means in the middle of the  
3 activation of said gas concentration sensor reaches said activation decision value  
4 and a detection current by said first cell falls within a predetermined range, a  
5 decision is made that said first cell reaches the activation.

1 7. The apparatus according to claim 1, further comprising means for  
2 implementing energizing control on a heater for the element activation so that,  
3 when a predetermined period of time elapses after the start of the heater  
4 energizing control in the middle of the activation of said gas concentration sensor,  
5 a decision is made that said first cell reaches the activation.

1 8. The apparatus according to claim 1, wherein an elapsed time after the  
2 decision is made that said first cell reaches the activation is measured and, when

3 the elapsed time reaches a predetermined time, a decision is made that said second  
4 cell reaches the activation.

1 9. The apparatus according to claim 8, wherein, when an elapsed time after  
2 said first cell reaches the activation reaches a predetermined time and a detection  
3 current by said second cell falls within a predetermined range, a decision is made  
4 that said second cell reaches activation.

1 10. The apparatus according to claim 8, further comprising a third cell for  
2 detecting a residual oxygen concentration of said gas after passing through said  
3 first cell so that, when an elapsed time after said first cell reaches the activation  
4 reaches a predetermined time and a detection current by said third cell falls within  
5 a predetermined range, a decision is made that said second cell reaches activation.

1 11. The apparatus according to claim 8, wherein said predetermined time is  
2 determined on the basis of a time needed for discharging all oxygen adsorbed onto  
3 a specific-gas active electrode of said second cell.